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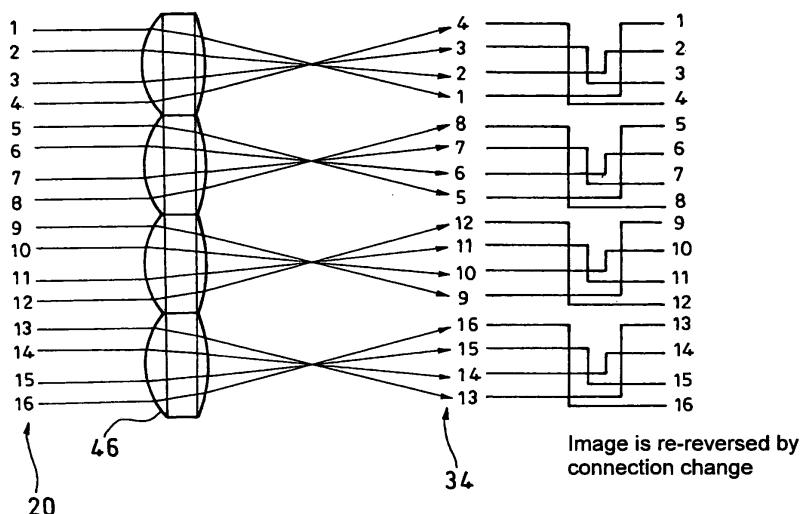
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(54) Photoelectric encoder

(57) A photoelectric encoder is provided which has an optical system including a first lens array inserted between a main scale and a light receiving element. An image divided or reversed by the first lens array can be

electrically or optically re-reversed. This can achieve the reduction of the entire size as well as increase in the scale field of view, while maintaining the image shape and/or pattern.

Fig. 13





EUROPEAN SEARCH REPORT

 Application Number
 EP 06 00 4767

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (IPC)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	WO 03/087706 A2 (HEIDENHAIN GMBH DR JOHANNES [DE]; BENNER ULRICH [DE]; MAYER ELMAR [DE]) 23 October 2003 (2003-10-23) * page 10, line 31 - page 12, line 24 * * figures 1,2 * * claim 1 *	1	INV. G01D5/347
Y	----- EP 1 099 936 A1 (RENISHAW PLC [GB]) 16 May 2001 (2001-05-16) * paragraph [0011] - paragraph [0018] * * paragraph [0024] - paragraph [0025] * * figure 2 *	6	
X	----- EP 1 487 199 A1 (FUJI PHOTO OPTICAL CO LTD [JP]; TAKAMI HASEGAWA [JP] FUJIFILM CORP [JP] 15 December 2004 (2004-12-15) * paragraph [0022] - paragraph [0023] * * paragraph [0056] - paragraph [0058] * * figures 1,5,6 *	1	
Y	----- -----	6	TECHNICAL FIELDS SEARCHED (IPC)
			G01D
The present search report has been drawn up for all claims			
3	Place of search Munich	Date of completion of the search 30 April 2014	Examiner Paraf, Edouard
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			



Application Number

EP 06 00 4767

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

6

None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 06 00 4767

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claim: 1

Incremental type photoelectric encoder having an optical system including a first lens array inserted between a main scale and a light receiving element, wherein pitches of the respective lenses are brought into agreement with a period of the main scale or natural number multiple thereof.

2. claims: 2-5

A photoelectric encoder having an optical system including a first lens array inserted between a main scale and a light receiving element, and wherein a second lens array with a set pitch of lenses identical to the first lens array and a third lens array that optically re-reverses the light emitted from the second lens array are provided.

3. claim: 6

A photoelectric encoder having an optical system including a first lens array inserted between a main scale and a light receiving element, and wherein connection of outputs of a light receiving element array is changed to electrically re-reverse an image that has been divided and reversed by the first lens array.

4. claim: 7

A photoelectric encoder having an optical system including a first lens array inserted between a main scale and a light receiving element, and wherein a second lens array with a set pitch of lenses identical to the first lens array, and a plurality of small mirrors with a set pitch identical to that of respective lenses of the lens arrays are provided to optically re-reverse an image that has been divided and reversed by the first lens array, by the small mirrors.

5. claims: 8-10

A photoelectric encoder having an optical system including a first lens array inserted between a main scale and a light receiving element, and wherein a second lens array with a set pitch of lenses identical to the first lens array, a mirror for making light emitted from the second lens array again be incident on the second lens array, and a half mirror for extracting the light passing through the second lens array twice towards a direction of the light receiving



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LACK OF UNITY OF INVENTION
SHEET B

Application Number

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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

element are provided to optically re-reverse an image that has been divided and reversed by the first lens array, by the mirror.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 00 4767

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

30-04-2014

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
WO 03087706	A2	23-10-2003	AT CN DE EP ES JP JP US WO	398760 T 1646883 A 10217726 A1 1497609 A2 2307959 T3 4266834 B2 2005522682 A 2005168757 A1 03087706 A2	15-07-2008 27-07-2005 27-11-2003 19-01-2005 01-12-2008 20-05-2009 28-07-2005 04-08-2005 23-10-2003
EP 1099936	A1	16-05-2001	EP JP JP US	1099936 A1 4714333 B2 2001194187 A 6603115 B1	16-05-2001 29-06-2011 19-07-2001 05-08-2003
EP 1487199	A1	15-12-2004	CN EP JP US	1573505 A 1487199 A1 2005004181 A 2005012843 A1	02-02-2005 15-12-2004 06-01-2005 20-01-2005